

**Descriptions – Zoology
of
Courses**

401. Comparative Physiology I

Fall. 4(3-4) PSL 240 or B S 212 and CEM 132. Interdepartmental with and administered by the Department of Physiology.

A comparison of osmoregulation, digestion, respiration, and other physiological processes in a wide range of organisms.

402. Comparative Physiology II

Winter. 4(4-0) PSL 401 or approval of department. Interdepartmental with the Department of Physiology.

A comparison of sensory, motor, endocrine and other integrative mechanisms in animals.

404. Biological and Ecological Concepts for Engineers and Mathematicians

Winter. 3(3-0) Approval of department. Interdepartmental with Systems Science.

Biological and ecological concepts important to formal analysis of living systems, vital properties, processes, and limitations; population dynamics, selection, competition, and predation; ecological community structure and function; industrialized ecosystem.

405. Experiments in Zoology I

Fall. 3(0-9) Approval of instructor.

A laboratory for Zoology majors. An integrated series of selected experiments in the topics of behavior, ecology and physiology.

406. Experiments in Zoology II

Winter. 3(0-9) Approval of instructor.

A laboratory for Zoology majors. An integrated series of selected experiments in topics of cell biology, embryology and genetics.

407. Experiments in Zoology III

Spring. 3(0-9) ZOL 405 or ZOL 406, approval of instructor.

A laboratory for Zoology majors. Special problems.

408. Freshwater Ecology

Summer. 6 Credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with Biological Science and the Department of Botany and Plant Pathology and administered by Biological Science.

The ecology of freshwater ecosystems, their biotic structure and the functional interrelationships of environmental variables regulating population dynamics, productivity and community structure. Extensive field investigations.

410. Terrestrial Ecology

Summer. 6 credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with Biological Science and the Department of Botany and Plant Pathology and administered by Biological Science.

Factors determining distribution and abundance. Interrelationship of plants, animals, and environment. Extensive field investigations of several types of terrestrial communities in light of current theory.

413. Animal Behavior

Spring. 4(4-0) B S 212.

Description of the known behavior of the various vertebrate and invertebrate phyla with emphasis upon adaptive significance. Thus, special attention will be given to mating, defensive, and nutritive behavior. The genetics and ontogeny of behavioral patterns will be presented where known. Behavior will be related to the ecology of various animal populations.

414. Biological Mechanisms of Animal Behavior

Winter of odd-numbered years. 3(3-0) or 5(3-6) ZOL 413 recommended.

Consideration of neurological and hormonal mechanisms controlling behavior. Emphasis will be upon mammalian systems, and will deal with the assumptions which underlie current concepts in the biology of behavior.

415. Ecological Aspects of Animal Behavior

Fall. 4(4-0) ZOL 413.

Consideration of orientation, navigation and homing behavior, food preferences, habitat selection, exploration, behavioral periodicity, communication, social organization and the embryology of behavior. In both vertebrates and invertebrates.

417. Advanced Developmental Biology

Spring. 3(3-0) or 5(3-6) ZOL 317.

Molecular and cellular biology of development. Complementary laboratory exercises with emphasis on experiments.

420. Ecology of Animal Parasites

Summer. 6 Credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with the departments of Microbiology and Public Health and Fisheries and Wildlife and administered by the Department of Microbiology and Public Health.

Parasitism of animals by protozoa, helminths and arthropods with emphasis on the interrelationships of host-parasite associations with the natural environments.

428. Morphology of the Chordates

Winter, Spring. 5(3-6) ZOL 303 or F W 301 or approval of instructor.

Comparative and functional morphology of chordates. Laboratory includes dissection of representatives of most vertebrate classes.

430. Vertebrate Paleontology

Winter. 4(3-3) ZOL 428, or approval of department. Interdepartmental with and administered by the Department of Geology.

Fossil vertebrates with emphasis on the evolution of major groups. Laboratories on modern techniques and on the identification and interpretation of fossils.

437. Invertebrate Paleontology

Fall. 4(3-4) GLG 202 or ZOL 303 or approval of department. Interdepartmental with and administered by the Department of Geology.

Systematics and evolution of marine invertebrates; uses of fossils in correlation and delineation of geologic time; structure and morphology of fossils as related to evolutionary development.

438. Paleogeology

Spring. 4(3-4) GLG 202 or ZOL 389 or approval of department. Interdepartmental with and administered by the Department of Geology.

Distribution and abundance of marine fossils; response of skeletal morphology to environmental conditions; uses of fossils in reconstructing ancient climates and depositional environments.

441. Fundamental Genetics

Fall, Spring. 5(5-0) B S 212. Students may not receive credit in more than one of the following: ZOL 341, ZOL 441.

Survey of principles of heredity in animals, plants, and microorganisms. Serves as single course in genetics for majors in any of the biological sciences, and as prerequisite for further work in genetics.

442. Advanced Genetics

Winter. 3(3-0) or 5(2-9) ZOL 441, MTH 108 or MTH 111 recommended.

Population genetics and the genetic analysis of evolution. Optional laboratory with individual research projects.

443. Developmental Genetics

Spring. 4(4-0) ZOL 441 and ZOL 317.

Mechanisms of gene action. Role of genes in the embryology, morphology, and physiology of organisms.

456. Foundations of Developmental Biology

Winter of even-numbered years. 3(3-0) ZOL 317; ZOL 417 recommended.

Reading and discussion of original research which posed significant problems of modern developmental biology.

460. Field Ornithology

Summer. 3 credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station.

The study of birds of the regional area, with emphasis on field techniques in relation to problems in avian identification, ecology and behavior.

461. Ornithology

Winter. 4(4-0) ZOL 320 or ZOL 428.

Principles of classification, structure, distribution, migration, population biology and life history of birds. Identification of birds by size, form and song.

462. Laboratory in Ornithology

Spring. 3(0-9) ZOL 461.

Field work with avian populations, foraging behavior, territoriality, time-activity, habitat selection and selected research topics.

471. Ichthyology

Spring. 3(2-3) FW 301 or ZOL 320 or ZOL 428. Interdepartmental with and administered by the Department of Fisheries and Wildlife.

Classification and Natural history of fishes. Emphasis on food, game, and forage fishes.

476. Limnology

Winter. 3(3-0) CEM 131 and CEM 161; BOT 450 or ZOL 389. Students may not receive credit for both F W 376 and F W 476. Interdepartmental with and administered by the Department of Fisheries and Wildlife.

Ecology of lakes and streams with special reference to physical, chemical and biological factors affecting their productivity.

477. Limnological Methods

Winter. 3(0-9) ZOL 481; F W 476 concurrently; ENT 301, ENT 302 recommended. Interdepartmental with and administered by the Department of Fisheries and Wildlife.

Methods and instruments of limnological field investigation on lakes and streams.

479. Soil Zoology

Fall. 4(2-6) B S 212.

Ecology and biology of soil-dwelling animals, with emphasis placed on protozoa, annelids and arthropods.

480. Biology of Fresh-Water and Terrestrial Invertebrates

Summer. 6 credits. ZOL 325 or approval of department. Given at W. K. Kellogg Biological Station.

Systematics and ecology of invertebrates with emphasis on the local fauna.

- 481. Invertebrate Zoology**
Fall. 5(3-6) ZOL 325 or approval of department.
Biology of invertebrates with special reference to their natural history, classification, distribution, and economic importance.
- 482. Biology of the Protozoa**
Winter. 3(3-0) or 5(3-6) B S 212.
Structures and functions of animal-like, eukaryotic microorganisms.
- 483. Physiological Ecology**
Winter. 4(3-2) B S 212.
Aspects of physiology that bear particularly on the interrelationships between animals and their environments.
- 484. Herpetology**
Spring. 5(3-6) ZOL 320 or ZOL 428.
Classification and natural history of amphibians and reptiles, with emphasis on Michigan species.
- 486. Mammalogy**
Fall. 4(2-6) ZOL 320 or ZOL 428.
Classification distribution, natural history of mammals with emphasis on Michigan species. Field studies, preparation of study specimens.
- 489. Animal Distribution**
Winter. 3(3-0) ZOL 441; ZOL 389 recommended.
Principles and patterns of animal distribution. Emphasis on major faunal regions, centers of origins, and concepts relating to the distribution of modern vertebrates.
- 492. Cytochemistry**
Spring. 4(3-3) B S 212.
General principles of microscopy, microtomy, fixation, embedding and sectioning of animal tissues; study of various cellular organelles and the localization of lipids, carbohydrates, proteins, nucleic acids and various hydrolytic enzymes in the cells.
- 495. Undergraduate Seminar**
Fall, Winter, Spring. 1(1-0) May reenroll for a maximum of 3 credits. Juniors, and approval of department.
Reading and discussion of articles relating to economic, social and environmental impact of new discoveries in biological sciences.
- 497. Principles of Endocrinology**
Winter. 4(4-0) One year organic chemistry; ZOL 317. Interdepartmental with the Department of Physiology.
Hormonal principles, illustrated by experimental observations, in vertebrates and invertebrates. Emphasis on cellular endocrinology. Group discussion, background in organic chemistry and cell biology strongly recommended. Term paper required.
- 499. Undergraduate Thesis**
Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 12 credits. Juniors, written approval of instructor.
Laboratory research culminating in the preparation and defense of an undergraduate thesis.
- 804A. Neuroscience Laboratory I**
Winter. 5(2-4) Approval of instructor. Interdepartmental with the departments of Biophysics, Physiology, and Psychology and administered by the Department of Psychology.
Development of skills in the methods, techniques and instrumentation necessary for research in a variety of areas concerned with neuroscience.
- 804B. Neuroscience Laboratory II**
Spring. 5(2-4) PSY 804A. Interdepartmental with the departments of Biophysics, Physiology and Psychology and administered by the Department of Psychology.
Continuation of ZOL 804A.
- 817. Ecology of Zooplankton**
Summer of every third year. Given in 1977. 3 credits. Given at W. K. Kellogg Biological Station.
Biology, distribution, and abundance of planktonic animals with special emphasis on life tables, filtering rates, food selection, production dynamics, fish predation, niche and species diversity.
- 820. Behavior of Animal Populations**
Fall. 4(4-0) ZOL 413 and written approval of department.
Behavior on the ecological level. Characteristics of populations rather than individuals will be stressed. Evolution will be considered on the population level.
- 821. Ontogeny of Behavior**
Winter of even-numbered years. 4(4-0) ZOL 317, ZOL 413.
Changing patterns of behavior during the development of individual animals; effects of experimental control of external environment, and neurological and chemical intervention upon behavior.
- 823. Neurological and Hormonal Correlates of Animal Behavior**
Spring. 4(4-0) ZOL 414, ZOL 415.
Lectures, papers and discussions on the neural and hormonal determinants of animal behavior. Emphasis will be placed upon mammalian behavior.
- 825. Tropical Biology: An Ecological Approach**
Winter, Summer. 12 credits. Approval of department and acceptance by Organization for Tropical Studies. Interdepartmental with and administered by the Department of Botany and Plant Pathology.
An introduction in the field to the principles of ecology as they operate in the tropics, especially concerning the tropical environment and biota, ecologic relations, communities and evolution in the tropics. Given in Costa Rica by Organization for Tropical Studies.
- 827. Basic Neurobiology**
Fall. 4(3-2) Approval of department. Interdepartmental with and administered by the Department of Biophysics.
A comparative survey of fundamental principles of nervous organization will be undertaken in lectures. Laboratory will emphasize examination of prepared neuroanatomical material and a demonstration of important neurophysiological phenomena.
- 830. Advanced Vertebrate Zoology**
Winter. 4(4-0) May reenroll for a maximum of 12 credits. ZOL 303; two years of undergraduate zoology and approval of department.
Advanced vertebrate biology including systematics, ecology, distribution, morphology.
- 833. Advanced Invertebrate Paleontology**
B. Quantitative Paleontology
Fall. 3(2-4) GLG 437 or GLG 438. Interdepartmental with and administered by the Department of Geology.
Application of mathematical tools to paleontological problems, including statistical applications and numerical taxonomy; computer applications.
C. Paleocology
Fall. 3(2-4) GLG 437 or GLG 438. Interdepartmental with and administered by the Department of Geology.
Advanced problems in population, community, and province level paleocology, primarily of marine invertebrates, including study of taxonomy, diversity, and adaptation.
D. Developmental Paleontology
Fall. 3(2-4) GLG 437 or GLG 438, ZOL 317 or approval of department. Interdepartmental with and administered by the Department of Geology.
Application of the principles of development to the ontogeny and phylogeny of fossil invertebrates as known from skeletal morphology.
E. Evolutionary Paleontology
Fall. 3(2-4) GLG 437 or GLG 438. Interdepartmental with and administered by the Department of Geology.
Aspects of evolutionary biology that can be studied in the fossil record, with emphasis on marine invertebrates.
- 834. Advanced Vertebrate Paleontology**
Winter of even-numbered years. 3(3-0) GLG 430 or approval of department. Interdepartmental with and administered by the Department of Geology.
Recent advances and controversial issues in vertebrate paleontology including origin, classification, phylogeny, and stratigraphic relationships of fossil vertebrates.
- 839. Population Ecology**
Summer. 6 credits. Approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with the Department of Botany and Plant Pathology.
An experimental-field approach to the study of populations and communities. Selected topics will deal with population growth, composition, predation, community structure and species abundance. This course is intended to complement ZOL 892.
- 843. Ecosystem Analysis, Design and Management**
Spring. 3(3-0) SYS 442 or ZOL 404. Interdepartmental with and administered by Systems Science.
Groups of students from various biological and non-biological disciplines will synthesize and analyze models of selected biological systems. Projects should yield information relevant to solution of contemporary ecological problems.
- 844. Problems in Human Genetics**
Spring. 5(5-0) ZOL 441 or approval of department.
Methods used in the study of human genetics and their application to medical, physiological and social problems. Laboratory consists of field trips and independent study selected by the student in consultation with the instructor.
- 845. Organic Evolution**
Winter. 4(4-0) ZOL 441 and a course in comparative biology.
A historical view of evolutionary thought, a presentation of the evolution of prebiological systems and a critical evaluation of the evolution of genetic systems.

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847. Analysis of Gene Organization and Transmission
Winter of odd-numbered years. 4(4-0) ZOL 441 and approval of department.
Formal and molecular analysis of gene organization and transmission in higher eucaryotes. Intended for graduate students with background in genetics and/or cytogenetics.

850. Ultrastructure
Fall. 4(2-6) BOT 427.
New developments in instrumentation and techniques of electron microscopy and their practical application in studying morphological and physiological changes in various organ systems.

857. Experimental Morphology
Spring. 4(3-1) ZOL 317.
Analysis of mechanisms of morphogenesis, particularly as these occur in post-gastrular stages of development. The significance of tissue interactions in developing and regenerating systems will be emphasized.

858. Neuroembryology
Spring. 4(4-0) ZOL 318 and approval of department.
Experimental analyses of morphogenesis of vertebrate nervous systems.

859. Analysis of Hormone Action
Spring. 4(4-0) ZOL 317 or approval of department. Interdepartmental with the Department of Physiology.
Discussion of recent work on the molecular and developmental aspects of hormone action in vertebrates and invertebrates. Selected topics to vary from year to year.

865. Advanced Neurobiology
Spring. 3(3-0) BPY 827. Interdepartmental with the departments of Biophysics, Biomechanics, Physiology and Psychology and administered by the Department of Biomechanics.
Basic organization, structure and function of neural networks comprising sensory, motor, and autonomic systems including examples from invertebrates and vertebrates.

871. Ecology of Fishes
Summer. 3(1-6) Approval of instructor or ZOL 389 or FW 473. Given at the W. K. Kellogg Biological Station. Interdepartmental with the Department of Fisheries and Wildlife.
Exploration of ecological problems with particular emphasis on growth, food and habitat selection, population biology and niche relations. Field and experimental investigations of fish communities.

878. Comparative Limnology
(478.) Summer. 6 credits. Approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with the Department of Botany and Plant Pathology.
Theoretical concepts and methods of analysis of environmental parameters influencing productivity of freshwaters. Comparative field investigations of lakes, streams, and other aquatic habitats.

881. Biology of the Arthropoda
Winter. 5(3-6) ZOL 481 or approval of department. Interdepartmental with the Department of Entomology.
Ecology, life cycles, morphology, taxonomy, and distribution of arthropoda other than insects.

882. Cellular Morphogenesis
Fall. 2(2-0) One course in biochemistry, approval of department.
Selected topics on the structure, biological processes and differentiation of living cells.

883. Laboratory in Cellular Morphogenesis
Fall. 2(0-6) Approval of department.
Laboratory work in cellular morphogenesis accompanying ZOL 882.

885. Vertebrate Neural Systems I
Fall of odd-numbered years. 5(3-4) Approval of department; ANT 815 and BPY 827 recommended. Interdepartmental with the departments of Biophysics, Physiology and Psychology and administered by the Department of Psychology.
Structure and function of major component systems of vertebrate brains, their evolution, ontogeny and comparative analysis in mammals, birds, reptiles, amphibians and fish. Interrelation of behavioral, anatomical and physiological studies.

886. Vertebrate Neural Systems II
Winter of even-numbered years. 5(3-4) PSY 885. Interdepartmental with the departments of Psychology, Biophysics and Physiology.
Continuation of ZOL 885. Major component systems of vertebrate brains, their evolution, ontogeny, and comparative analysis in mammals, birds, reptiles, amphibians and fish. Interrelation of behavioral, anatomical, and physiological studies.

890. Special Problems
Fall, Winter, Spring, Summer. 1 to 15 credits. Two years of undergraduate zoology. Approval of department.
Consideration of current problems.

891. Current Topics in Ecological Research
Summer. 1 credit. May reenroll for a maximum of 4 credits. Approval of department. Given at W. K. Kellogg Biological Station.
Discussions and special problem work; current theoretical views and investigations; treatment of the dynamics of energy and biomass in terrestrial and aquatic ecosystems; methods of analysis.

892. Dynamics of Biologic Populations
Winter. 5(4-3) One statistics course, 1 ecology course or approval of department.
Quantitative analyses of the dynamics, production, regulation, energetics and distribution of animal populations.

893. Fertilization and Early Embryogenesis
Fall. 3(3-0) Developmental biology, biochemistry and approval of department. ZOL 894 recommended concurrently.
Developmental biology of early stages of animal life, emphasis on physiology and biochemistry of marine invertebrate eggs.

894. Methods in Cellular and Developmental Biology
Fall. 3(1-6) Cellular and developmental biology, biochemistry and approval of department.
Theory and practice of research methods in cellular and developmental biology, with emphasis on physicochemical approaches.

895. Seminar Topics
Fall, Winter, Spring. 1 credit per term. May reenroll for a maximum of 6 credits. Approval of department.
Graduate level seminars on current research topics in biology.

896. Animal Community Ecology
Winter of odd-numbered years. 4(4-0) ZOL 892, approval of instructor.
Patterns and processes in animal communities with emphasis on structure, species diversity and stability.

899. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
Research for the master's degree in genetics, morphology, mammalogy, wildlife management, ornithology, fisheries biology, limnology, quantitative biology, invertebrate, experimental embryology, animal behavior, herpetology.

999. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
Research for the Ph.D. degree in genetics, morphology, mammalogy, wildlife management, ornithology, fisheries biology, limnology, quantitative biology, invertebrate, experimental embryology, animal behavior, herpetology.